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Old Crow River Stratigraphic Reconnaissance, 1976

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OLD CROW RIVER STRATIGRAPHIC RECONNAISSANCE, 1976

W. N. Irving[1]

In 1976 test excavations were made at seven exposures on the Old Crow River between collecting localities 11A and 12 (see Map). The purpose was to study the lower glaciolacustrine sediments and overlying fluviatile deposits there which have been informally correlated with units defined by Hughes (1972) on the Porcupine River (cf. also Lichti-Federovitch, 1973, 1974). Detailed observations were recorded at five of the excavations; four of these partial stratigraphic sections are reported here. It is hoped that they can be integrated with observations by Westgate and Rutter made earlier in the same field season. However, because this was a reconnaissance, and because other stratigraphic work in the area may be expected to define sedimentary units more precisely, no attempt has been made to assign formal designations to the units discussed here.

A large number of investigators have visited these sites briefly in 1975 and 1976. In 1975 J. C. Ritchie measured and sampled a section at Loc. 12. In 1976, J. Westgate and N. Rutter measured sections at Loc. 12 and N. Rutter measured a section at Loc. 11. Lichti-Federovitch (1973) reports on pollen in samples collected by O. L. Hughes from an exposure (her no. 6) near those reported here. Harington et al (1975) and Irving and Harington (1973) give additional data and interpretations.

Loc. 11

Since 1966, OCR Loc. 11 has produced a small number of vertebrate fossils, collected by Harington and others, in that and subsequent years. It is most notable for its excellent exposure of about 25 metres of stratigraphic section, the upper 20 m. of which have been sampled and described by N. Rutter in 1976.

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[1] This report has been modified and improved as a result of discussion with J. Cinq-Mars.

The top of the section is capped by a thin layer of peat which overlies fine grained alluvium to a thickness of 2-3 m. Bones (Bison) attributed to this alluvium have been radiocarbon dated to about 11-12,000 B.P. The bones show no evidence of human modification (Harington, et al, 1975).

Beneath the upper alluvium lies a deposit tentatively identified as lacustrine, which is characterized by clayey, silty sediments which tend to flow when thawed. This is commonly referred to as the "upper lake sediments", and is tentatively correlated with unit 6 described by Hughes (1972) on the Porcupine River, which is attributed by him to a glacio-lacustrine event connected with the Late Wisconsin maximum advance of Laurentide ice[1.] (see also, Lichti-Federovitch, 1973, p. 556).

Below the upper glacio-lacustrine sediments lie some 18-20 m. of fine-grained alluvium, with cross-bedding, ripple marks, and a high degree of sorting of particles between clay and coarse sand all prominently displayed. In some layers, thick deposits of peat and detrital wood occur, and the shells of small mollusca are common; however, no vertebrate fossils have been recorded as having been found in situ in this "interlake alluvium" at Loc. 11. This is tentatively correlated with Hughes' Units 4 and 5 on the Porcupine River.

Below the "interlake alluvium" lie the "lower glacio-lacustrine sediments", which are reported on here. These are visible, under slumped overburden, as massive, often jointed silty clays with occasional larger particles of wood or stone. They extend to an unknown depth below the low-water level of the Old Crow River. Nothing is known of deposits that may underlie the "lower lake sediments" in the Old Crow Basin.

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1. Hughes (1972) infers that the Laurentide glacier, which had reached the summit of passes through the Richardson Mountains, and northern Mackenzie Mountains, prevented its own meltwater and other run-off from draining into the Mackenzie Valley. At that time the Porcupine drainage outlet to the Yukon did not exist at its present level, so this water was impounded in the Old Crow and other basins.

The excavation at Loc. 11 began at Rutter's point 18.55, which was still in place on August 6. This was near the break in slope from a near-vertical face to a slope of 10-20° toward the river.

Particular care was taken to distinguish between material that had been deposited recently and that which was stratigraphically below a younger layer of Pleistocene age. This required excavation to depths of as much as two metres, to expose a continuous section which showed a plausible stratigraphic sequence in which deposition by the modern Old Crow River could be ruled out.

From 18.55 to about 19.90 the sediments appeared to be alluvial, and contained large quantities of organic detritus, mostly wood. At about 19.90 a fairly marked transition occured, from well-sorted and bedded material rich in sand, to poorly sorted or unsorted clay-silt with occasional pebbles, pieces of wood, and lenses of sand.

The deposit below 19.90 appears nearly uniform, except that silt and larger particles become progressively less numerous with increasing depth. Those parts that are close to the surface tend to be brown, whereas those that are deeply buried, and those that are lowest in elevation are blue-grey in colour. Presumably this differential oxidation reflects differential exposure to air during recent conditions of thaw. Jointing is more conspicuous in the deeper parts of the deposit.

The presence of both coarse and fine particles, and the apparent lack of depositional layering within the upper part of the "lower lake sediments" below 19.90 leads one to suspect that previously existing laminae have been obliterated and the sediments mixed by solifluction. The presence of large particles of stone and wood perhaps could be attributed to ice rafting and the time of deposition of the clays. However, it is significant that the large particles including sand, gravel and wood are less numerous in deeper parts of the deposit. The broad particle size distribution and the relatively poor sorting of materials near the top of the deposit seen in the field may result from the surface of the deposit having been exposed to a freeze-thaw cycle and also the introduction of particles by lateral transport, during an erosion interval.

These observations suggest correlation of the deposit below 19.90 m. at Loc. 11 with Hughes' (1972) Unit 3, and the post depositional disturbance indicated by poor sorting with the cryoturbation recorded in Hughes' Unit 4.

It is noteworthy that twigs were found in all the excavated levels of the "lower lake sediments", and that a very strong odour of hydrogen sulphide, presumably from decomposed organic material, issued from the lowest part of the excavation. These observations suggest that the larger environment of that time supported significant biological activity. The wood fragments might have been drawn from pre-existing deposits. However, it seems unlikely that enough organic material to produce hydrogen sulphide would have been redeposited in this way. This observation must be viewed in relation to an hypothesis that these glacio-lacustrine sediments may be biologically sterile, which is yet to be confirmed.

Loc. 11N

Two test trenches 30 m. apart at 11N, some 50-80 m. upstream from the end of the highest terrace, gave substantially the same results. Only one is described here.

The excavation began about 4.01 m. above the river on 7 August, and was carried step-fashion down the 25-30° slope to 50-60 cm. above the river, where the slope changes to 5-10°. At this point a vertical shaft was sunk to 1 m. below river level, making a total vertical exposure at this point of 2.63 m.

At 2.2-4.0 a layer of recent clay-silt rillwash is underlain by 5-50 cm. of banded grey sands with interspersed layers of silt, peat, and woody detritus. This is clearly distinguishable from the underlying massive silty, sandy grey clay with occasional pebbles. The banded sands apparently dip, but were not exposed far enough to provide conclusive evidence of a disconformity between them and the clay unit.

The massive clays continue downward to the bottom of the excavation and beyond to an unknown depth. Pebbles and wood fragments are numerous in the upper portion but become less common in parts of the lower.

There are small stringers of coarse material, ranging from sand to fine gravel, usually accompanied by wood, at 2.5, 1.6, and 0.4-5.0 m. No wood was noted below 0.4 m.

What appears to be charcoal was noted at about 2.5 m. and also at 1.6 m., where a sample was taken.

It appears that the lower parts of the section, below 2.0 m., have not been much disturbed since the time of original deposition. Above this level, in contrast, no depositional features are preserved and the massive, undifferentiated sandy clays appear to have been reworked by solifluction. Thus, a disconformity may be postulated between the top of the massive grey clays and the banded grey sands noted between 3.25 and 3.75. In this respect, the section resembles closely that recorded at Loc. 11; however, depositional features were not noted in the lower part of the latter section as they have been here.

Loc. 11-3

OCR Loc. 11-3, informally called Ironstone Bar, was first investigated in 1975 when it was noted that iron-cemented sand plaques occured there in great abundance, that some of these could be observed in place, and that some of the plaques contained pieces of wood and bone.

Excavation in 1976 confirmed these observations; however, no other pieces of bone were found in iron-cemented plaques.

The datum point for the excavation was 1.65 m. above the Old Crow River on August 6. It may be tied in with excavations at Locs. 11 and 11N measured with reference to the river on August 6 and 7.

The excavation was begun at a point where the surface slopes at about 15-25° and carried horizontally a little more than 4 m. toward the river. The surface of the northernmost 2 m. of the trench slopes at about 5°, and is covered by plaques of iron-cemented sand. The surface material on the steaper, southern part of the section is brown-tan fine sand, judged to be recent colluvium.

The recent colluvium, of variable thickness, overlies a massive bed of silty, sandy grey clay with occasional pebbles. Although slightly different in colour, this unit resembles in texture the zone at Loc. 11 between 19.90 and 22.55, which is 4-6 m. above the river.

At approximately 40 and 50 cm. below datum, there are horizontal stringers of coarse sand and fine gravel stained reddish brown. Below this, to a depth of about 1.2 m. below datum, there are alternating bands of sandy gravel and silty grey clay; where the particles are largely sand and silt, weakly cemented flat-lying plaques are seen lying in place. These are in most cases grey. Below 1.2 m., to 1.4 m. and an unknown depth below that, the deposit is a massive coarse grey sand.

Tentatively, it is suggested that the clays and coarse sands in the section exposed at 11-3 correlate with the erosion interval inferred at Locs. 11, 11-3 and 12 (below). It may be that the coarse sands at 11-3 were laid down as beach and pond or lagoon deposits when the base level was at or below that of the modern Old Crow River.

Loc. 12

At Locality 12, on August 5-7, extensive vertical faces and tests near the base of the bluff revealed a stratigraphic situation of such complexity that efforts to record its characteristics in detail had to be abandoned for lack of time.

In brief, a series of thick, cross-bedded and deformed deposits of peat, sand, and unsorted clay-rich colluvium were found between Rutter's control point at 14.70 m. and approximately 45 cm. above the river, at 18.90 m., where apparently undisturbed blue-grey silty clay was encountered.

It appears likely that the cross-bedded and deformed deposits just described correlate with events that caused the obliteration of depositional features at Locs. 11 and 11N, that is with an interval of erosion and subaerial weathering probably including congeliturbation.

A large wedge of sand that intersects layers of peat at Loc. 12 could have formed either as a permafrost feature or as a result of downslope movement near the edge of a cut bank. In either case, subaerial conditions and probably erosion are indicated, which suggests correlation also with Hughes' Unit 4 on the Porcupine River.

In 1970, heavily rolled vertebrate fossils and a cobble were excavated from a peat layer at Loc. 12 which was a part of the cross-bedded and deformed series described above. A sketch of the section in which these were found is available in field notes.

In summary, the reconnaissance observations recorded here suggest that

1. The "lower lake" or "lower glacio-lacustrine" sediments frequently noted along the Old Crow River are in fact lacustrine. Doubts about this probably are based on observation of only the upper part of the deposit.
2. The lower lake was not exclusively a deep-water phenomenon.
3. Conditions around the lower lake supported tree growth, at least during the latter part of its existence; alternatively, the observed wood all may have been derived from older deposits.
4. The deposition of the lower lake sediments was followed by a significant interval of largely subaerial geomorphic activity, during which stream base levels were at or below that of the modern Old Crow River. This is represented by the cross-bedded and deformed deposits at Loc. 12, the disturbance of lake deposits at Locs. 11 and 11N, and possibly also by the deposition of coarse sands and clays at Loc. 11-3. This period may possibly be correlated in whole or in part with events represented in Hughes' Unit 4 on the Porcupine River.
5. Following that interval, deposition resumed with the transport of fine alluvium and plant detritus forming deposits up to 20 m. thick, which may be subdivided. Because it is difficult to distinguish organic materials that grew during the time of deposition of this (and other) units from those that originated in older deposits, radiocarbon dates obtained from these deposits must be interpreted with caution, as possibly indicating a maximum possible age of the deposit, rather than a true or a minimum radiocarbon age.

6. A correlation of the lower lake sediments described here with Hughes' (1972) Unit 3 on the Porcupine River is plausible.

It remains possible to conjecture that vertebrate fossils and artefacts of Man will be found concentrated in sediments at or below the level of the Old Crow River, which were deposited following the deposition of the lower lake sediments described here.

References:

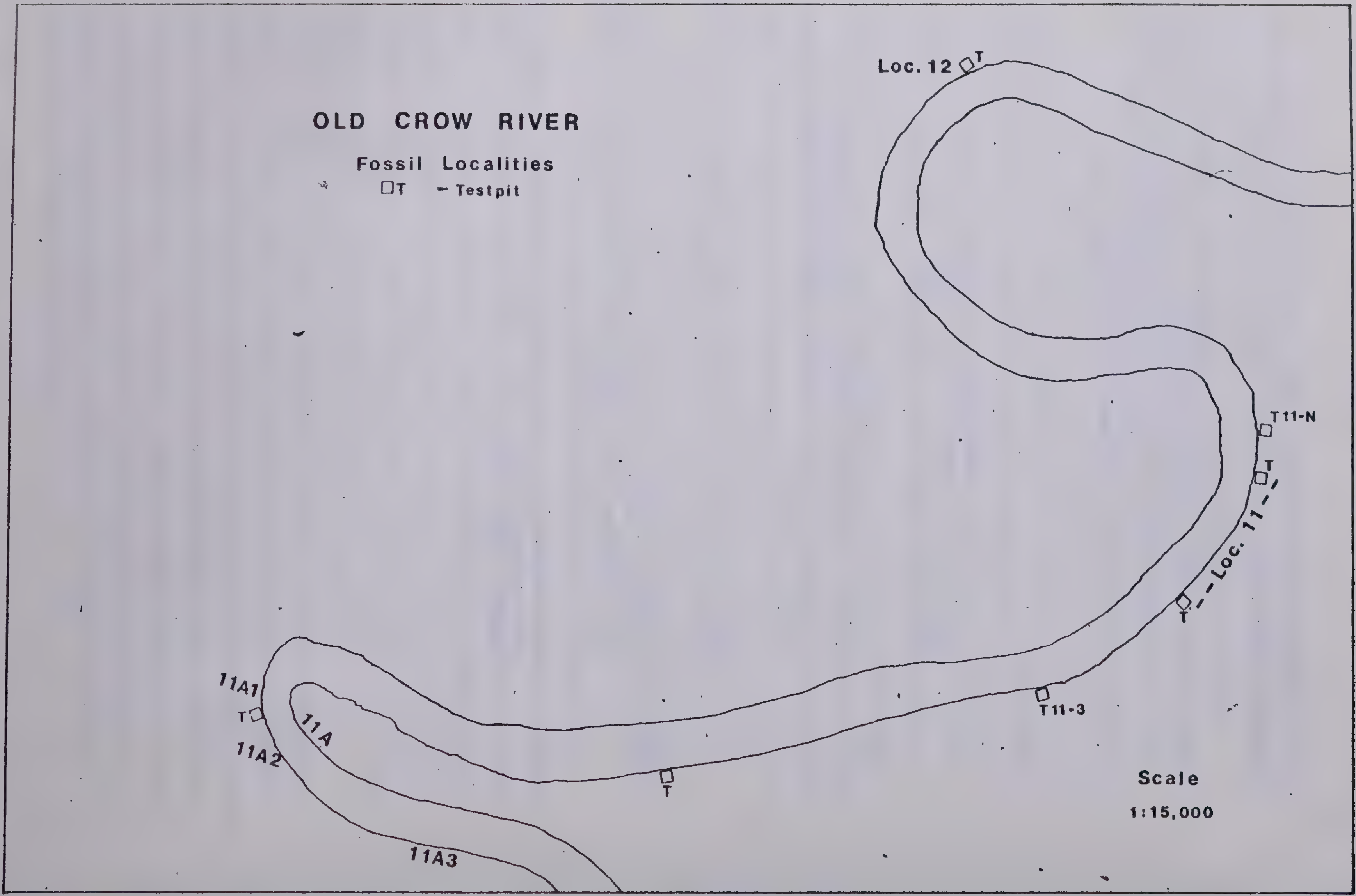
Harington, C. R., Robson Bonnichsen and Richard E. Morlan
1975 Bones say Man lived in Yukon 27,000 years ago. Canadian Geographical Journal, Vol. 91, Nos. 1 & 2, pp. 42-48.

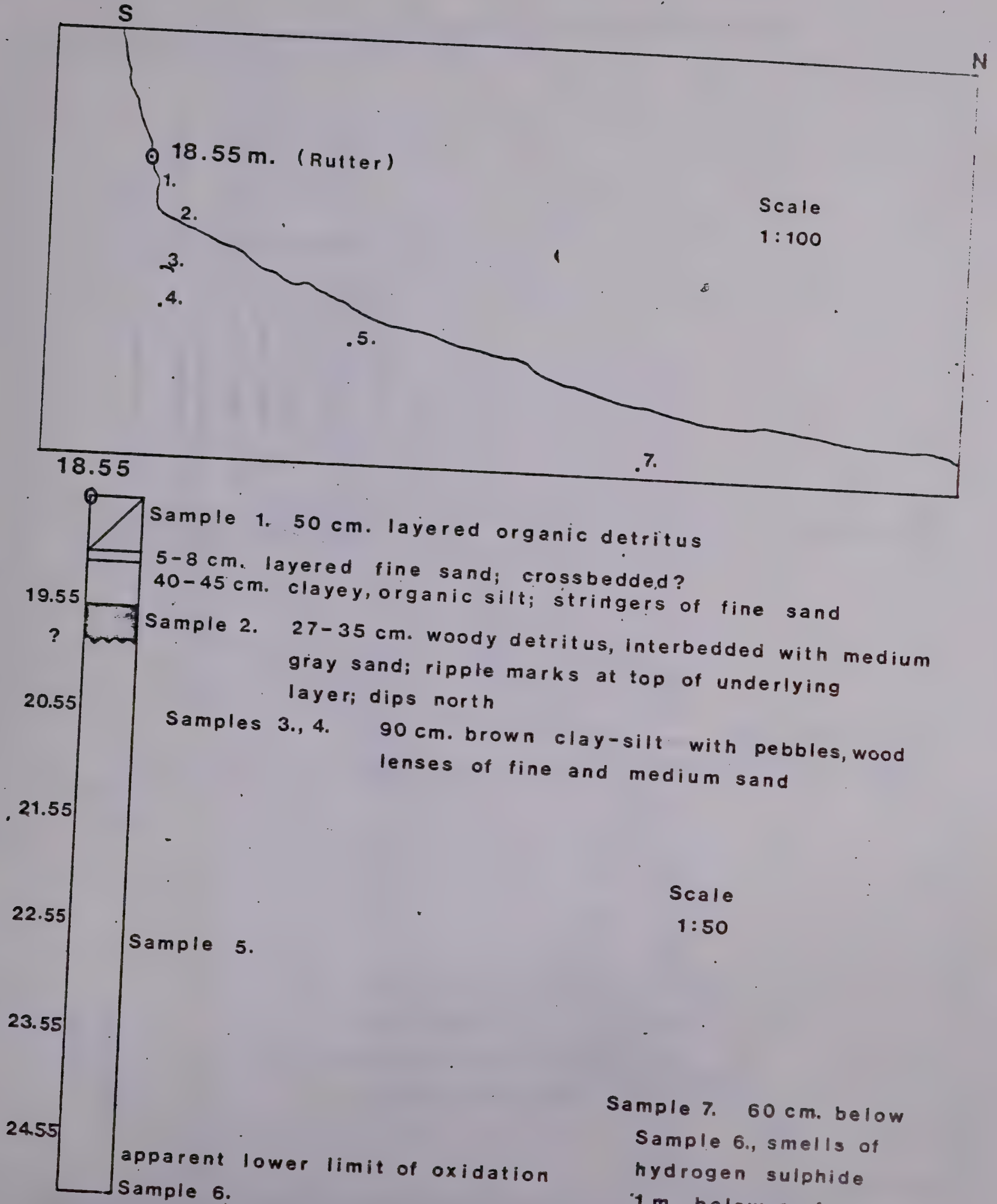
Hughes, O. L.
1972 Surficial Geology of Northern Yukon Territory and Northwestern District of Mackenzie, Northwest Territories. Geological Survey of Canada. Paper 69-36 (Report and Map 1319A). Ottawa.

Irving, W. N. & C. R. Harington
1973 Upper Pleistocene radiocarbon dated artefacts from the northern Yukon. Science, Vol. 179, pp. 335-340.

Lichti-Federovitch, Sigrid
1973 Palynology of six sections of Quaternary sediments from the Old Crow River, Yukon Territory. Canadian Journal of Botany, Vol. 51, No. 3, pp. 553-564.

1974 Palynology of two sections of late Quaternary sediments from the Porcupine River, Yukon Territory. Geological Survey of Canada. Paper 74-23.


OLD CROW RIVER
Fossil Localities
□T – Testpit
Loc. 12
T
T11-N
T
Loc. 11
T
T11-3
T
11A1
T
11A
11A2
11A3
Scale
1:15,000



Sample 1. 50 cm. layered organic detritus

5-8 cm. layered fine sand; crossbedded?

40-45 cm. clayey, organic silt; stringers of fine sand

Sample 2. 27-35 cm. woody detritus, interbedded with medium gray sand; ripple marks at top of underlying layer; dips north

Samples 3., 4. 90 cm. brown clay-silt with pebbles, wood lenses of fine and medium sand

Sample 5.

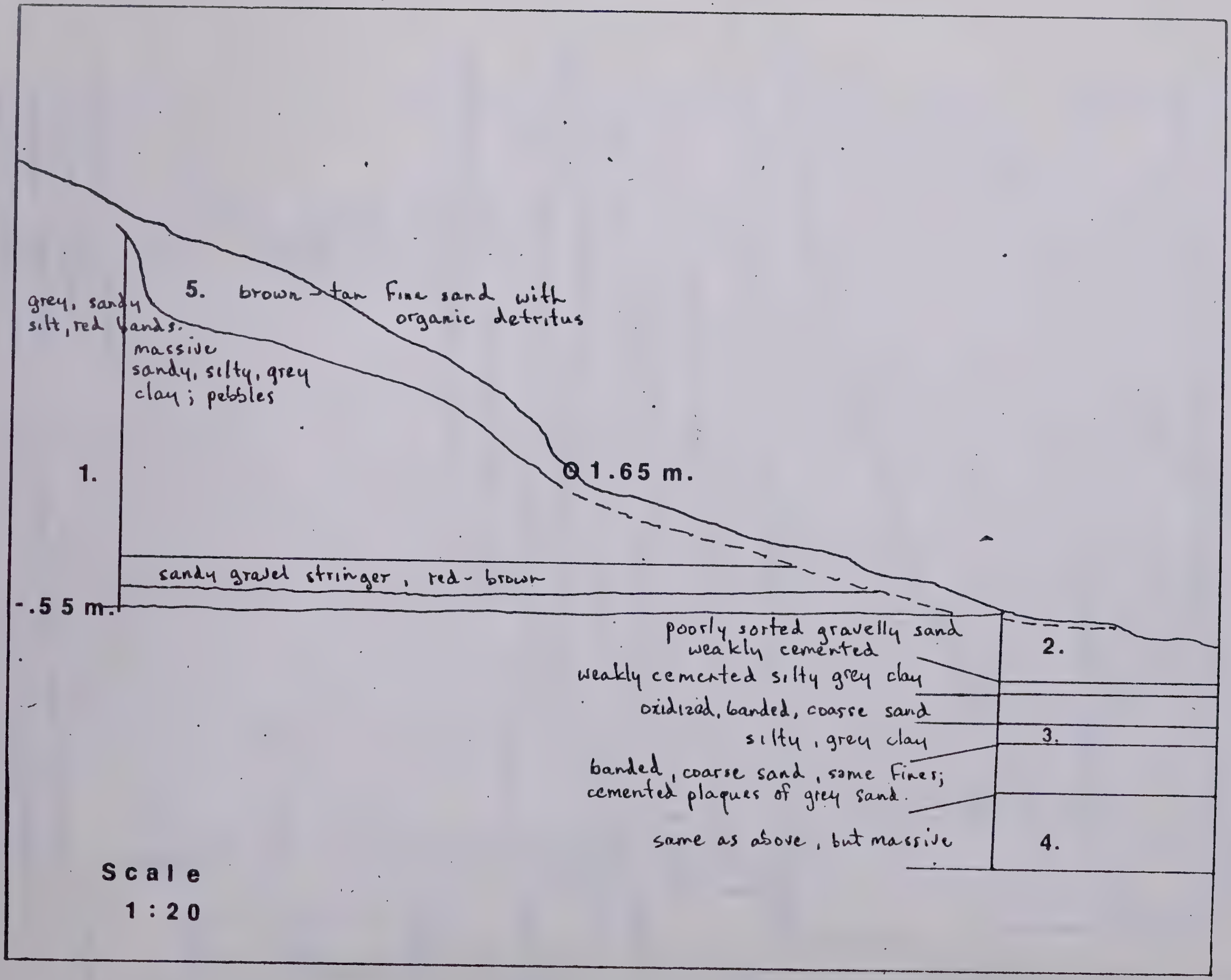
apparent lower limit of oxidation

Sample 6.

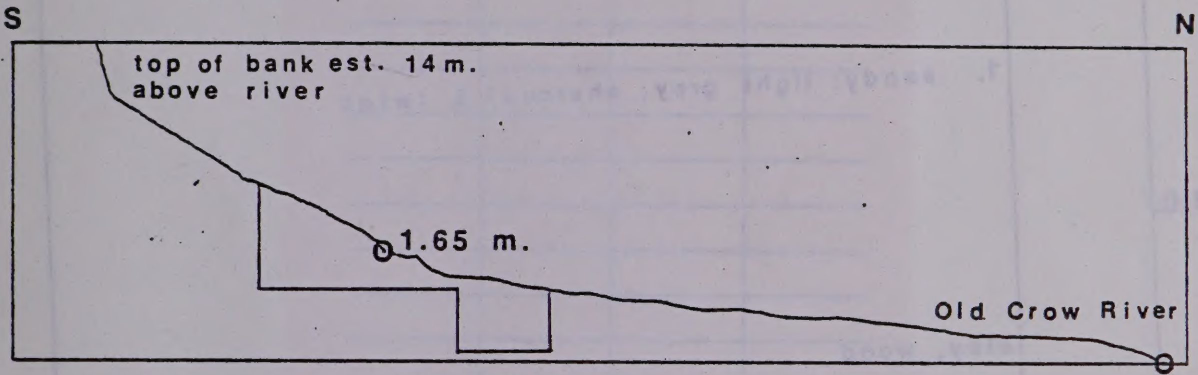
Sample 7. 60 cm. below Sample 6., smells of hydrogen sulphide 1 m. below surface.

OCR 11

Rutter's sample area 35 m. upstream from gully

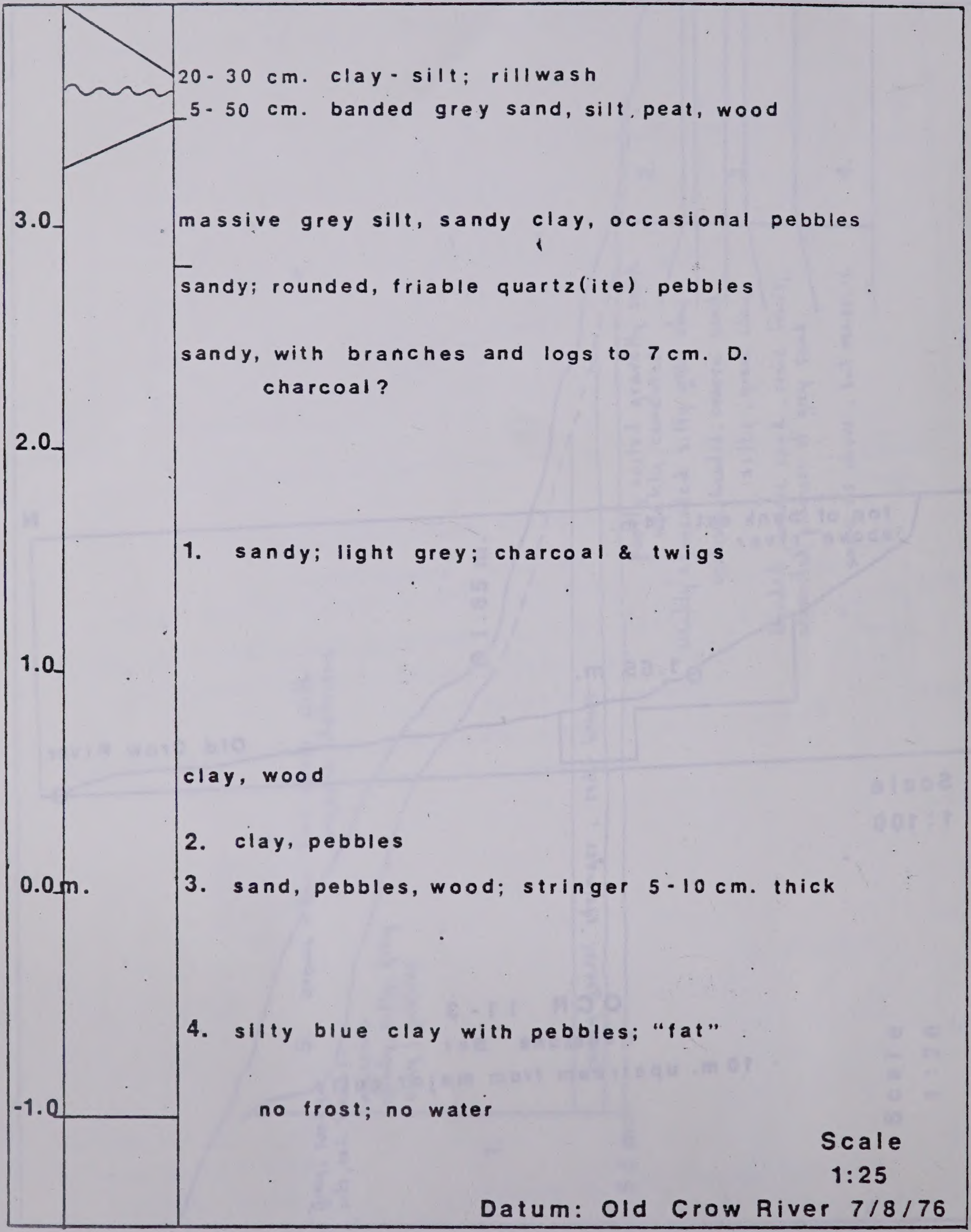

grey, sandy silt, red bands.
5. brown-tan Fine sand with organic detritus
massive sandy, silty, grey clay; pebbles
1.
1.65 m.
sandy gravel stringer, red-brown
-.55 m.
poorly sorted gravelly sand weakly cemented
2.
weakly cemented silty grey clay
oxidized, banded, coarse sand
silty, grey clay
3.
banded, coarse sand, some Fines; cemented plaques of grey sand.
same as above, but massive
4.
Scale
1:20

OCR 11-3
Ironstone Bar
10 m. upstream from major gully



Scale
1:100

OCR 11-3
Ironstone Bar
10 m. upstream from major gully


20-30 cm. clay-silt; rillwash
5-50 cm. banded grey sand, silt, peat, wood
3.0
massive grey silt, sandy clay, occasional pebbles
sandy; rounded, friable quartz(ite) pebbles
sandy, with branches and logs to 7 cm. D.
charcoal?
2.0
1. sandy; light grey; charcoal & twigs
1.0
clay, wood
2. clay, pebbles
0.0 m.
3. sand, pebbles, wood; stringer 5-10 cm. thick
4. silty blue clay with pebbles; "fat"
-1.0
no frost; no water
Scale
1:25
Datum: Old Crow River 7/8/76

OCR LOC. 11 N.

50 m. upstream from highest bluff at Loc. 11

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